CERTAIN PARASITIC INSECTS.

BY A. S. PACKARD, JR.

THE subject of our discourse is not only a disagreeable but too often a painful one. Not only is the mere mention of the creature's name of which we are to speak tabooed and avoided by the refined and polite, but the creature itself has become extinct and banished from the society of the good and respectable. Indeed under such happy auspices do a large proportion of the civilized now live that their knowledge of the habits and form of the louse may be represented by a blank. Not so with some of their great-great-grandfathers and grandmothers if history, sacred and profane, poetry, and the annals of literature testify aright; for it is comparatively a recent fact in history that the louse has awakened to find himself an outcast and an alien. Among savage nations of all climes, some of which have been dignified with the apt, though high sounding name of Phthiriophagi, and among the Chinese and other semi-civilized peoples, these lords of the soil still flourish with a luxuriance and rankness of growth that never diminishes, so that we may say without exaggeration that certain mental traits and fleshly appetites induced by their consumption as an article of food may have been created, while a separate niche in our anthropological museums is reserved for the instruments of warfare, both offensive and defensive, used by their phthiriophagous hunters. Then have we not in the very centres of civilization the poor and degraded, which are most faithfully attended by these revolting satellites!

But bantering aside, there is no more engaging subject to the naturalist than that of animal parasites. Consider the great proportion of animals that gain their livelihood by stealing that of others. While a large proportion of plants are more or less parasitic, they gain thereby in

interest to the botanist, and many of them are eagerly sought as the choicest ornaments of our conservatories. Not so with their zoological confrères. All that is repulsive and uncanny is associated with them, and those who study them, though perhaps among the keenest intellects and most industrious observers, speak of them without the limits of their own circle in subdued whispers or under a protest, and their works fall under the eyes of the scantiest few. But the study of animal parasites has opened up new fields of research, all bearing most intimately on those two questions that ever incite the naturalist to the most laborious and untiring diligence—what is life and its origin? The subjects of the alternation of generations, or parthenogenesis, of embryology and biology, owe their great advance, in large degree, to the study of such animals as are parasitic, and the question whether the origin of species be due to creation by the action of secondary laws or not, will be largely met and answered by the study of the varied metamorphoses and modes of growth, the peculiar modification of organs that adapt them to their strange modes of life, and the consequent variation in specific characters so remarkably characteristic of those animals living parasitically upon others.*

With these considerations in view surely a serious, thoughtful, and thorough study of the louse, in all its varieties and species, is neither belittling nor degrading, nor a waste of time. We venture to say, moreover, that more light will be thrown on the classification and morphology of insects by the study of the parasitic species, and other degraded, wingless forms that do not always live parasitically, especially of their embryology and changes after leaving the egg, than by years of study of the more highly developed insects alone. Among Hymenoptera the study of the minute Ichneumons, such as the Proctotrupids and Chalcids, especially the egg-parasites;

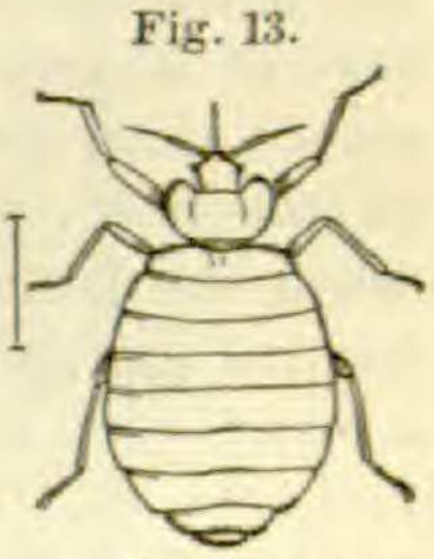
---

* We notice while preparing this article that a journal of Parasitology has for sometime been issued in Germany—that favored land of specialists. It is the "Zeitschrift für Parasitenkunde," edited by Dr. E. Hallier and Dr. F. A. Zürn. 8vo, Jena.

among moths the study of the wingless canker-worm moth and Orgyia; among Diptera the flea, bee-louse (*Braula*), sheep tick, bat ticks, and other wingless flies; among Coleoptera, the Meloë, and singular Stylops and Xenos; among Neuroptera the snow insect, Boreus, the Podura and Lepisma, and especially the hemipterous lice, will throw a flood of light on these prime subjects in philosophical entomology.

Without farther apology, then, and very dependent on the labor of others for our information we will say a few words on some interesting points in the natural history of lice. In the first place, how does the louse bite? It is the general opinion among physicians, supported by able entomologists, that the louse has jaws, and bites. But while the bird lice (*Mallophaga*) do have biting jaws, whence the Germans call them skin-eaters (*pelzfresser*), the mouth parts of the genus Pediculus, or true louse, resemble in their structure those of the bed-bug (Fig. 13, from the author's "Guide to the Study of Insects") and other Hemiptera. In its form the louse closely resembles the bed-bug, and the two groups of lice, the Pediculi and Mallophaga, should be considered as families of Hemiptera, though degraded and at the base of the hemipterous series. The resemblance is carried out in the form of the egg, the mode of growth of the embryo, and the metamorphosis of the insect after leaving its egg.

Fig. 13.



Bed-bug.

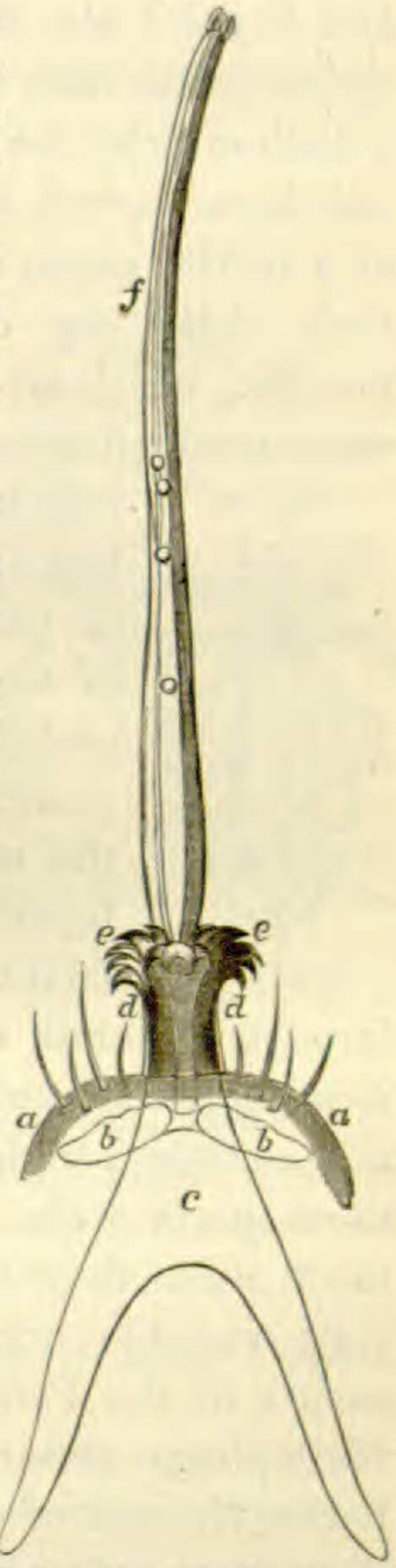
Schiödte, a Danish entomologist, has, it seems to us, forever settled the question as to whether the louse bites the flesh or sucks blood, and decides a point interesting to physicians, *i.e.* that the loathsome disease called phthiriasis, from which not only many living in poverty and squalor are said to have died, but also men of renown, among whom Denny in his work on the Anoplura, or lice, of Great Britain, mentions the name of "Pheretima, as recorded by Herodotus, Antiochus Epiphanes, the Dictator Sylla, the two Herods, the Emperor Maximian, and Phillip the Sec-

ond," is a nonentity. Schiödte, in his essay "On Phthirius, and on the Structure of the Mouth in Pediculus" (Annals and Magazine of Natural History, 1866, page 213), says that these statements will not bear examination, and that this disease should be placed on the "retired list," for such a malady is impossible to be produced by simply blood-sucking animals, and that they are only the disgusting attendants on other diseases. Our author thus describes the mouth parts of the louse.

"Lice are no doubt to be regarded as bugs, simplified in structure and lowered in animal life in accordance with their mode of living as parasites, small, flattened, apterous, myopic, crawling and climbing, with a conical head, moulded as it were to suit the rugosities of the surface they inhabit, provided with a soft, transversely furrowed skin, probably endowed with an acute sense of feeling, which can guide them in that twilight in which their mode of life places them. The peculiar attenuation of the head in front of the antennæ at once suggests to the practised eye the existence of a mouth adapted for suction. This mouth differs from that of Rhynchota [Hemiptera, bed-bug, etc.] generally in the circumstance that the labium is capable of being retracted into the upper part of the head, which therefore presents a little fold, which is extended when the labium is protruded. In order to strengthen this part, a flat band of chitine is placed on the under surface, just as the shoemaker puts a small piece of gutta-percha into the back of an India-rubber shoe; as, however, the chitine is not very elastic, this band is rather thinner in the middle, in order that it may bend and fold a little when the skin is not extended by the lower lip. The latter consists, as usual, of two hard lateral pieces, of which the fore ends are united by a membrane so that they form a tube, of which the interior covering is a continuation of the elastic membrane in the top of the head; inside its orifice there are a number of small hooks, which assume different positions according to the degree of protrusion; if this is at its highest point the orifice is turned inside out, like a collar, whereby the small hooks are directed backwards, so that they can serve as barbs. These are the movements which the animal executes after having first inserted the labium through a sweat-pore. When the hooks have got a firm hold, the first pair of setæ (the real mandibles transformed) are protruded; these are, towards their points, united by a membrane so as to form a closed tube, from which, again, is exserted the second pair of setæ, or maxillæ, which in the same manner are transformed into a tube ending in four small lobes placed crosswise. It follows that when the whole instrument is exserted, we perceive a long membranous flexible tube hanging down from the labium, and along the walls of this tube the setiform mandibles and maxillæ in the shape of long narrow bands of chitine. In this way the tube of

suction can be made longer or shorter as required, and easily adjusted to the thickness of the skin in the particular place where the animal is sucking, whereby access to the capillary system is secured at any part of the body. It is apparent, from the whole structure of the instrument, that it is by no means calculated on being used as a sting, but is rather to be compared to a delicate elastic probe, in the use of which the terminal lobes probably serve as feelers. As soon as the capillary system is reached, the blood will at once ascend into the narrow tube, after which the current is continued with increasing rapidity by means of the pulsation of the pumping ventricle and the powerful peristaltic movement of the digestive tube."

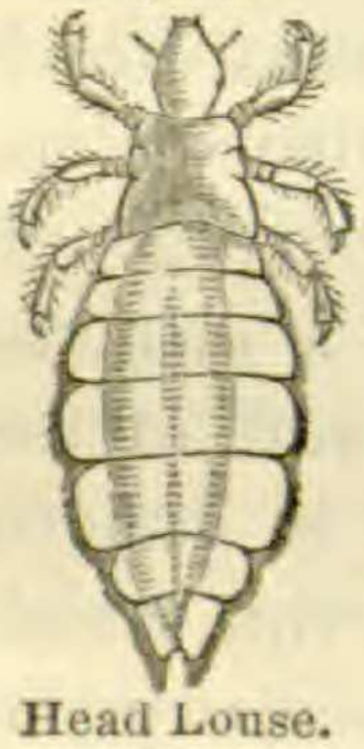
Fig. 14.*



Mouth of the Louse.

If we compare the form of the louse (Fig. 15, *Pediculus capitis*, the head louse; Fig. 16, *P. vestimenti*, the body louse) with the young bed-bug as figured by Westwood (Modern Classification of Insects, ii, p. 475) we shall see a very close resemblance, the head of the young Cimex being proportionally larger than in the adult, while the thorax is smaller, and the abdomen is more ovate, less rounded; moreover the body is white and partially transparent. The beak of the bed-bug we have studied from some admirable preparations made by Mr. E. Bicknell for the Museum of the Peabody Academy.

Fig. 15.



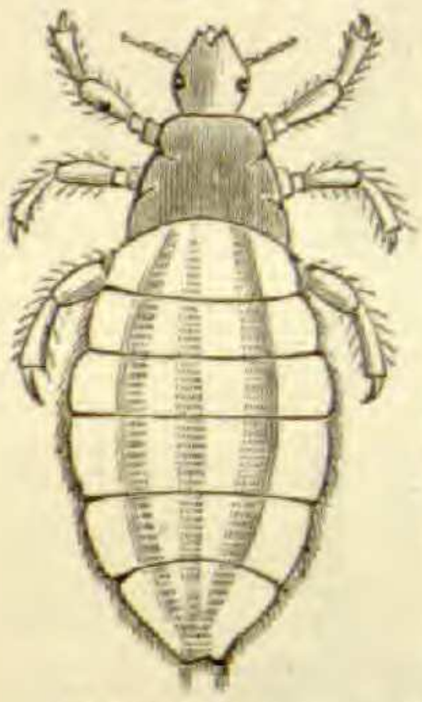
Head Louse.

Under a high power of the microscope specimens treated with diluted potash show that the man-

*Figure 14 represents the parts of the mouth in a large specimen of *Pediculus vestimenti*, entirely protruding, and seen from above, magnified one hundred and sixty times; *aa*, the summit of the head, with four bristles on each side; *bb*, the chitinous band, and *c*, the hind part of the lower lip — such as they appear through the skin by strong transmitted light; *dd*, the foremost protruding part of the lower lip (the haustellum); *ee*, the hooks turned outwards; *f*, the inner tube of suction, slightly bent and twisted; the two pairs of jaws are perceived on the outside as thin lines; a few blood globules are seen in the interior of the tube.

dibles and maxillæ arise near each other in the middle of the head opposite the eyes, their bases slightly diverging. Thence they converge to the mouth over which they meet and beyond are free, being hollow, thin bands of chitine, meeting like the maxillæ, or tongue, of butterflies to form a hollow tube for suction. The mandibles each suddenly end in a curved, slender filament, which is probably used as a tactile organ to explore the best sites in the flesh of their victim for drawing blood. On the other hand the maxillæ, which are much narrower than the mandibles, become rounded towards the end, bristle-like, and tipped with numerous exceedingly fine barbs, by which the bug anchors itself in the flesh, while the blood is pumped through the mandibles. The base of the large, tubular labium, or beak, which ensheathes the mandibles and maxillæ, is opposite the end of the clypeus or front edge of the upper side of the head, and at a distance beyond the mouth equal to the breadth of the labium itself. The labium, which is divided into three joints becomes flattened towards the tip, which is square, and ends in two thin membranous lobes, probably endowed with a slight sense of touch. On comparing these parts with those of the louse it will be seen how much alike they are, with the exception of the labium, a very variable organ in the Hemiptera. From the long sucker of the Pediculus, to the stout chitinous jaws of the Mallophaga, or bird lice, is a sudden transition, but on comparing the rest of the head and body it will be seen that the distinction only amounts to a family one, though Burmeister placed the Mallophaga in the Orthoptera on account of the mandibles being adapted for biting. It has been a common source of error to depend too much on one or a single set of organs. Insects have been classified on characters drawn from the wings, or the number of the joints of the tarsi, or the form of the mouth parts. We must take into account in

Fig. 16.



Body Louse.

endeavoring to ascertain the limits of natural groups, all the organs collectively, as well as the internal anatomy and the embryology and metamorphosis of insects, before we can hope to obtain a natural classification.

The family of bird lice is a very extensive one, embracing many genera, and several hundred species. One or more species infest the skin of all our domestic and wild mammals and birds, some birds sheltering beneath their feathers four or five species of lice. Before giving a hasty account of some of our more common species, we will give a sketch of the embryological history of the lice,* with especial reference to the structure of the mouth parts.

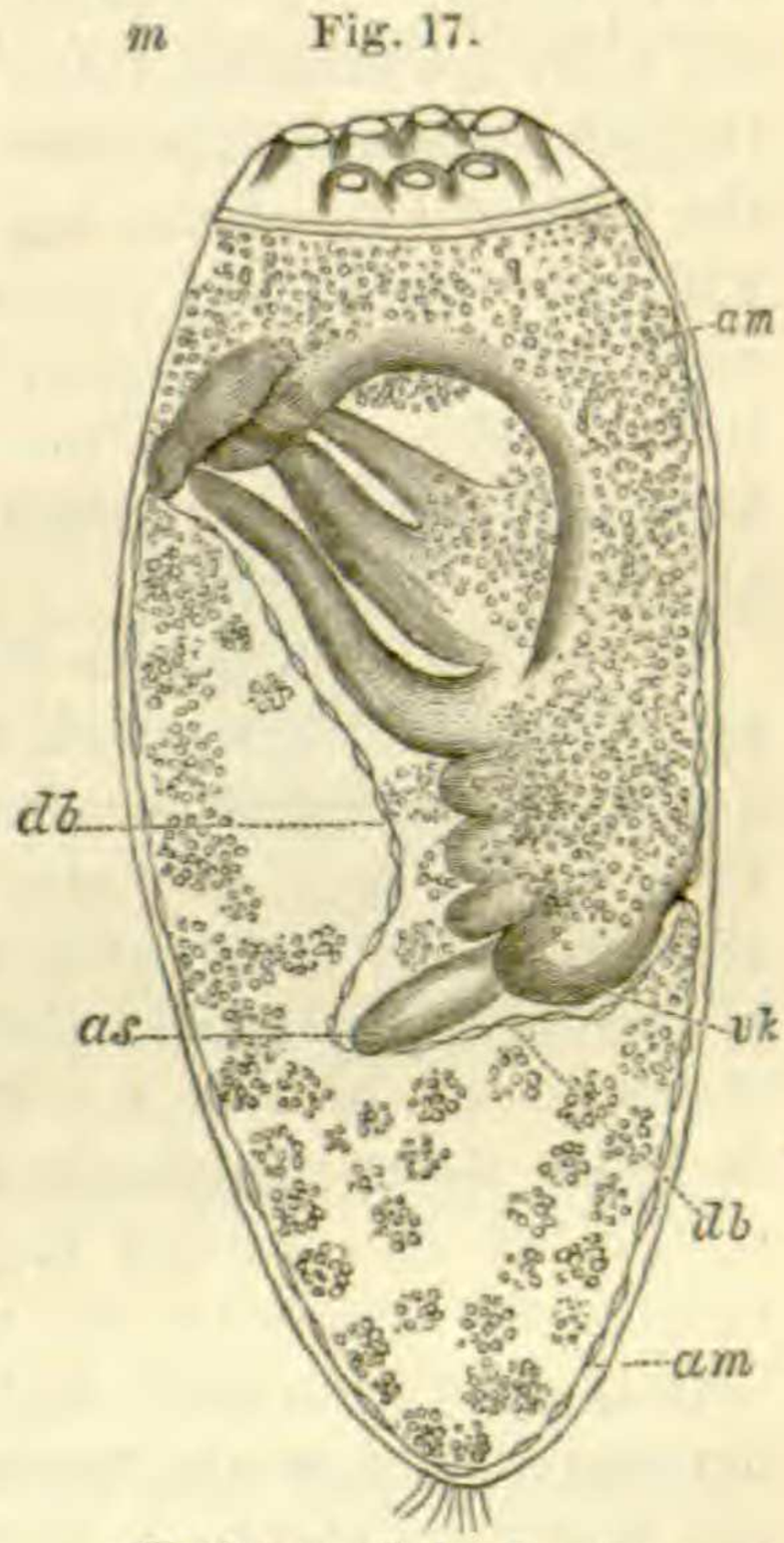


Fig. 17.

Embryo of the Louse.

The eggs (Fig. 17, egg of *Pediculus capitis*) are long, oval, somewhat pear-shaped, with the hinder end somewhat pointed, while the anterior end is flattened, and bears little conical micropyles (*m*, minute orifices for the passage of the spermatozoa into the egg), which vary in form in the different species and genera; the opposite end of the egg is provided with a few bristles. The female attaches her eggs to the hairs or feathers of her host.

After the egg has been fertilized by the male, the blastoderm, or primitive skin, forms, and subsequently two layers, or embryonal membranes, appear; the outer is called the amnion (Fig. 17, *am*) (though as Melnikow states, it is not homologous with the amnion of vertebrates), while the inner

---

*For my information on the development of the lice I am indebted to Professor Nicolaus Melnikow's "Treatise on the Embryonal Development of Insects" in Wiegmann's Archiv für Naturgeschichte, 1869, p. 136.

is called the "visceral membrane" (Fig. 17, *db*). Melnikow remarks that

"In all the insects whose embryology has been studied, and in which the ventral primitive streak is developed, neither does the amnion nor the visceral membrane take any part in building up the body of the embryo, since they are provisional structures in a peculiar sense of the word. Quite different relations exist in the lice. The origin of the embryonal membranes of the louse occurs at the time of the formation of the primitive streak. The thickened blastoderm of the end of the egg on which the hairs are situated folds in, and this fold is the beginning of the primitive streak and of the visceral membrane. The layer of this fold facing the ventral side of the egg, is transformed into the visceral membrane, while the other layer, opposite to the other side of the egg, becomes thickened and forms the primitive streak. The remaining portion of the blastoderm, with the exception of the primitive streak, which forms the forehead (in the more extended sense of the word) consists of the so-called amnion.

In contradistinction to those insects [Simulium, Chironomus, Donacia and Phryganidæ] in which a ventral primitive streak is developed, neither do the amnion nor visceral membrane form a capsule surrounding the contents of the egg. The amnion is intimately connected with the cephalic portion of the embryo as also with the visceral membrane. This latter is connected only with the abdominal part of the primitive streak, and the edges of the side, *i. e.* the continuation of the amnion. In opposition to those above-mentioned insects which have a ventral primitive streak, in the lice the visceral membrane and amnion share in building up the body of the embryo while they pass upon the dorsal side of the embryo.

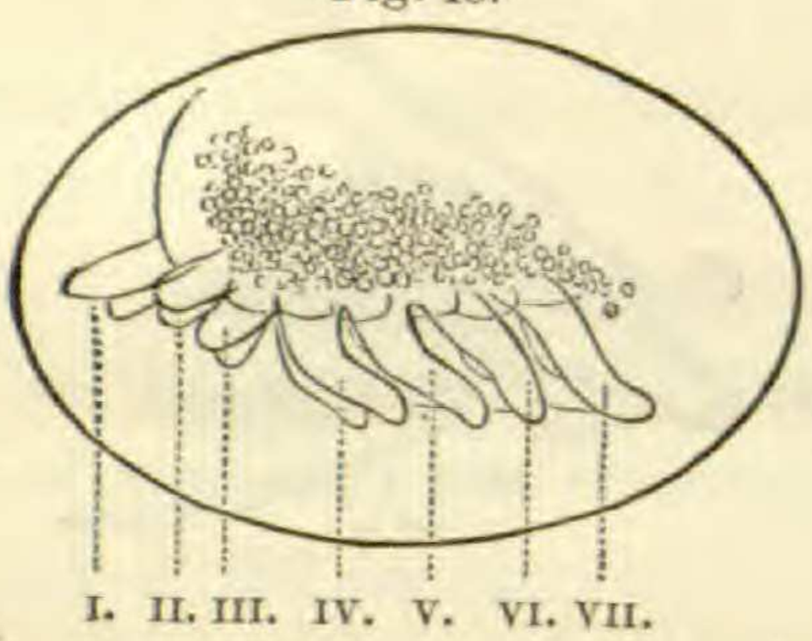
It appears from these facts that the differences which we see in the embryonal membranes of insects, are in direct relation to the mode in which the primitive streak is formed. It seems, therefore, that the mode of origin of the primitive streak, or its position in relation to the yolk is concerned in the above-mentioned differences of the embryonal membranes.*

---

*Melnikow does not consider, as his fellow countryman, Metznikow, does, that the embryonal membranes of insects are homologous with those of vertebrates. He says, "the mode of origin in all vertebrates is the same. The formation of the visceral membrane and amnion of insects varies in different groups, with different modes of formation of the primitive streak. The embryonal membranes of vertebrates have a certain relation to the allantois, but the embryonal membranes of insects are correlated to the peculiar embryo of these animals. The reciprocal relations of the embryonal membranes; their relation to the whole egg and embryo are the same in all vertebrates; but in insects differences arise, which become noticeable in the position of the primitive streak in relation to the yolk. Finally, these embryonal membranes in all vertebrates are provisional, but in insects this is not the case. They are provisional only in those which have a ventral primitive streak," (Melnikow). We see, therefore, that immediately after the fertilization of the egg, great and radical differences exist between the eggs of vertebrates and articulates, and even between different groups of the latter. Those who in popular lectures and books make the sensational statement that

Again, looking at the louse's egg and its germ (Fig. 17) we see the amnion (*am*) surrounding the yolk mass, and the visceral membrane (*db*) within, partially wrapping the rude form of the embryo in its folds. The head (*vk*) of the embryo is now directed towards the end of the egg on which the hairs are situated; afterwards the embryo revolves on its axis and the head lies next to the opposite end of the egg. Our embryo previous to this important change of position may be compared with the embryo of the dragon fly (Figs.

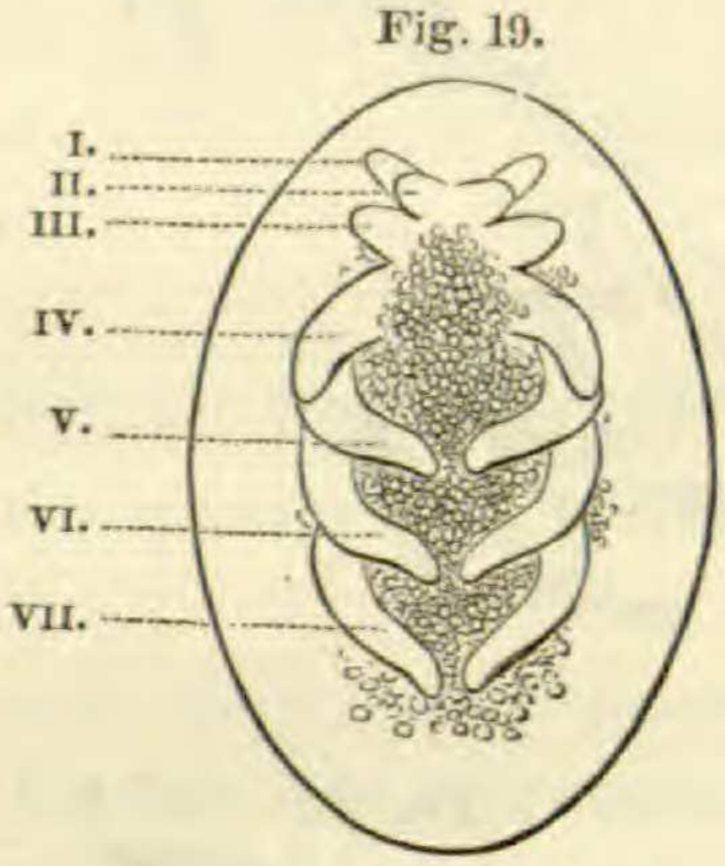
Fig. 18.



Embryo of the Dragon-fly, side view; I. antennæ; II. mandibles; III. maxillæ; IV. second maxillæ (labium); V.–VII. legs.

Fig. 19, ventral view of the same.

Fig. 19.



18, 19). Eight tubercles bud out from the under side of the head, of which the foremost and longest are the antennæ (*as*), those succeeding are the mandibles, maxillæ, and second maxillæ, or labium. Behind them arise six long, slender tubercles forming the legs, and the primitive streak rudely marks the lower wall of the thorax and abdomen, not yet formed. Figure 20 represents the head and mouth parts of the embryo of the same louse; *vk* is the forehead, or clypeus; *ant*, the antennæ; *mad*, the mandibles; *max*[1], the first pair

---

at first the eggs of all animals, as well as the early stages of the embryo, are alike, have not regarded the important differences presented at the first sketching out of the embryo. The great differences between the two branches of vertebrates and articulates arise before the most rudimentary form of the embryo is indicated; indeed it may be said with truth, at the first beginnings of life. Those also who indulge in glittering generalities regarding the identity in the structure of the eggs of animals, and the protoplasmic matter of which they are composed, should also take into account the radical differences of the mode of action of this protoplasm (*i. e.* egg-contents, yolk and albumen) in the eggs of vertebrates and insects at the dawn of life, whether they be due to the "vital force," or to some chemical force conserved and metamorphosed into a life-giving power.

of maxillæ and *max*^{2}, the second pair of maxillæ, or labium. At this time the embryo may be compared with that of the dragon fly of the same period of growth (Fig. 24 *c*, clypeus; 1, antennæ; 2, mandibles; 3, maxillæ; 4, labium; 5, 6, 7, legs.) We see that the mouth parts of the louse, so unlike those of other adult insects, are originally similar to them. Figure 21 represents the mouth parts of the same insect a

Fig. 20.

Fig. 21.

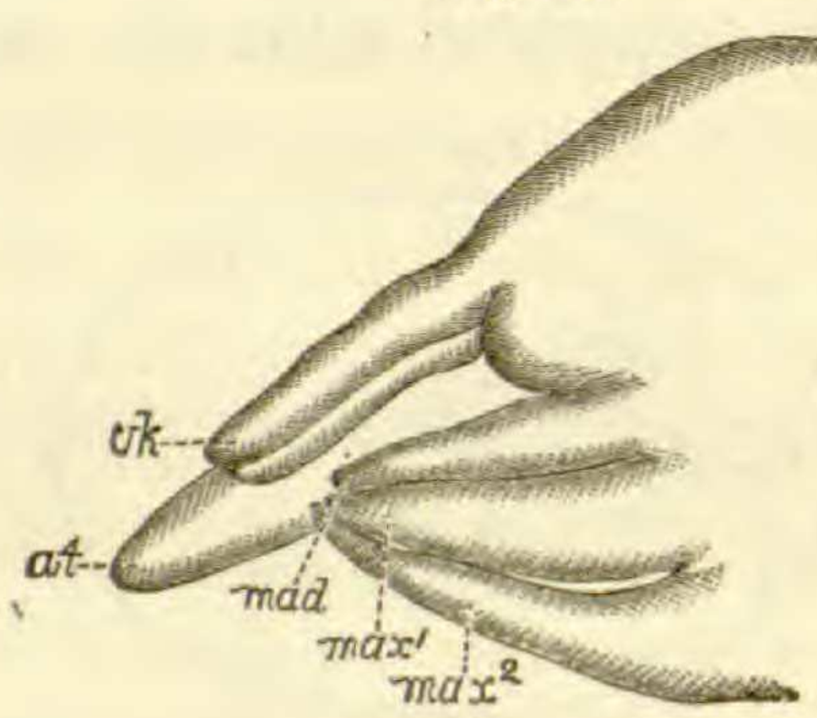


Fig. 22.

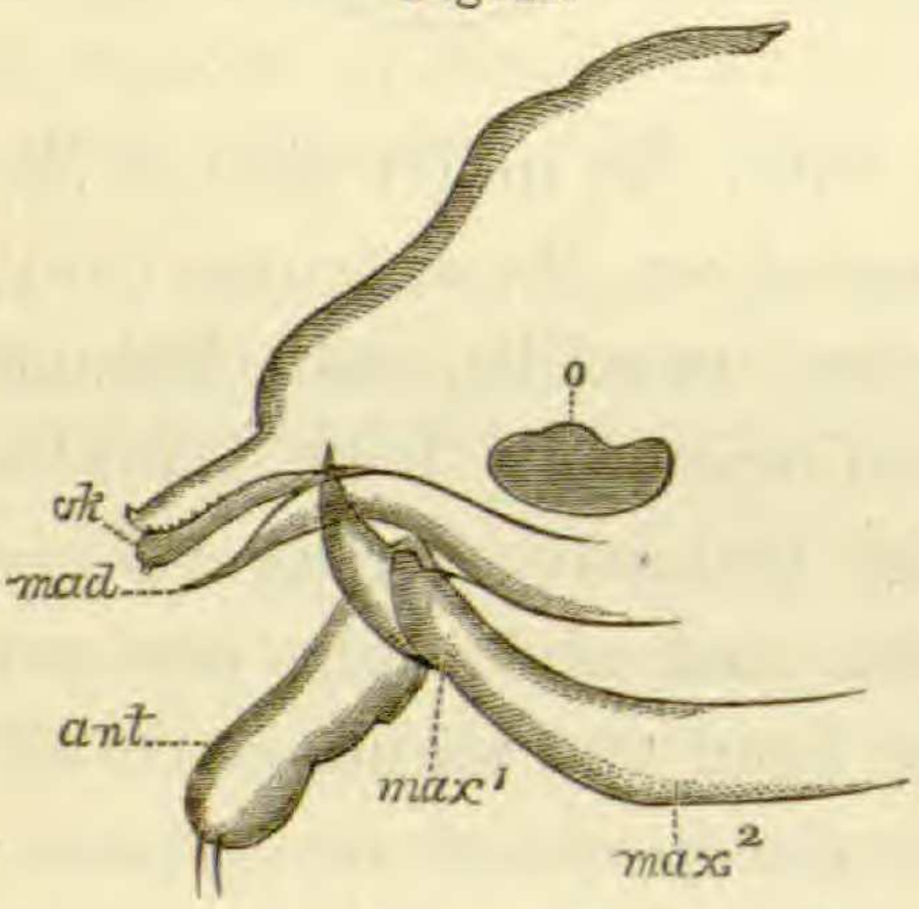
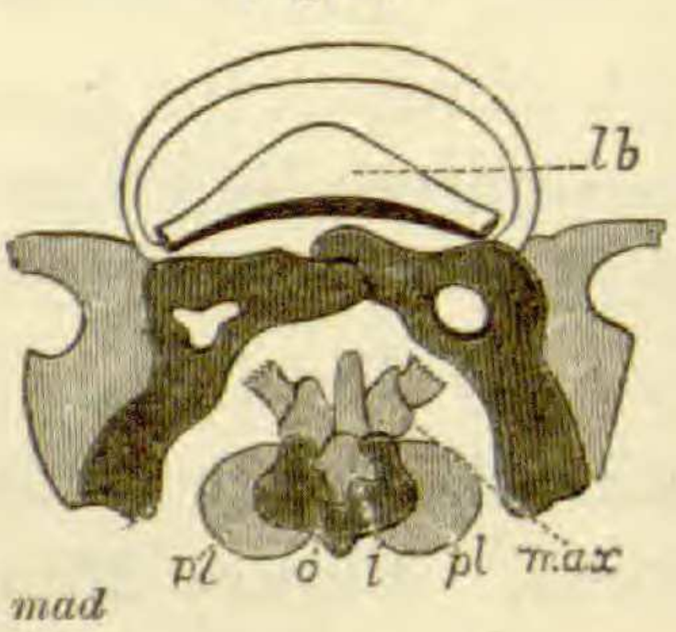


Fig. 23.



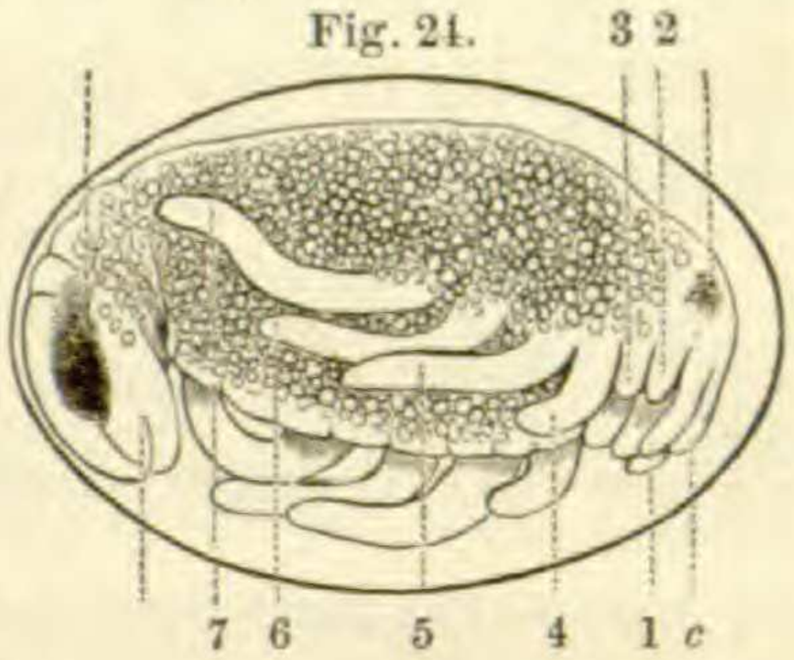
DEVELOPMENT OF THE MOUTH PARTS OF THE LOUSE.

little farther advanced, with the jaws and labium elongated and closely folded together. Figure 22 represents the same still farther advanced; the mandibles (*mad*) are sharp, and resemble the jaws of the Mallophaga; and the maxillæ (*max*^{1}) and labium (*max*^{2}) are still large, while afterwards the labium becomes nearly obsolete. Figure 23 represents the mouth parts of a bird louse, Goniodes; *lb*, is the upper

lip, or labrum, lying under the clypeus; *mad*, the mandibles; *max*, the maxillæ; *l*, the lyre-formed piece; *pl*, the "plate," and *v*, the beak or tongue. (This, and Figs. 20, 21, 22, are from Melnikow).

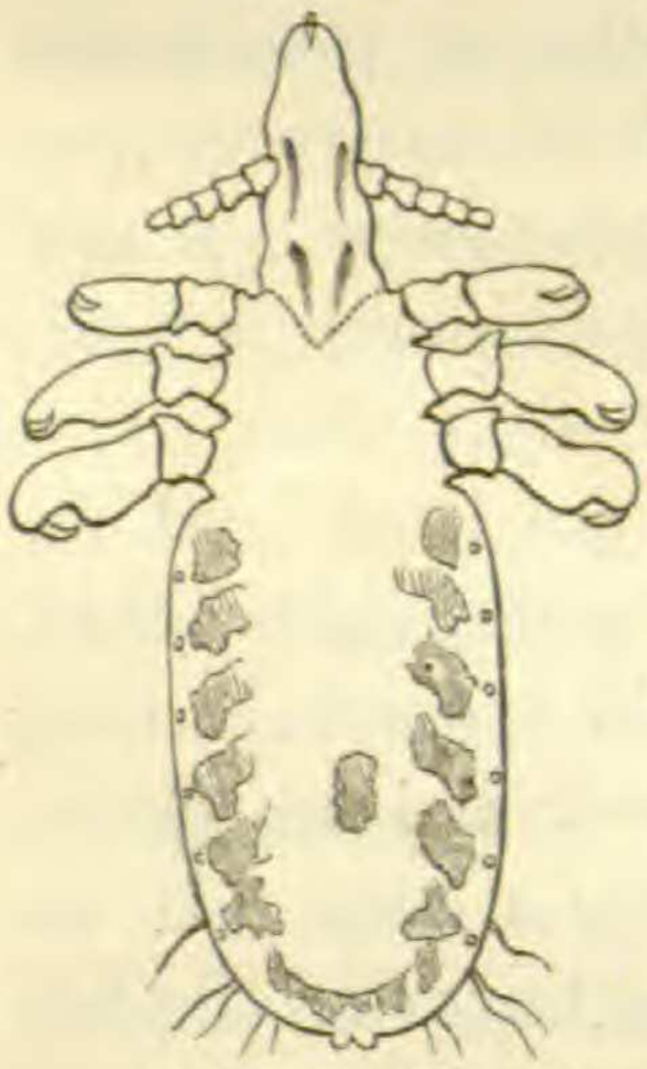
We will now describe some of the common species of lice found on a few of our domestic animals, and the mallophagous parasites occurring on certain mammals and birds. The family Pediculina, or true lice, is higher than the bird lice, their mouth parts, as well as the structure of the head, resembling the true Hemiptera, especially the bed bug. The clypeus, or front of the head, is much smaller than in the bird lice, the latter retaining the enlarged forehead of the embryo, it being in some species half as large as the rest of the head.

Fig. 24.



All of our domestic mammals and birds are plagued by one or more species of lice. Figure 25 represents the *Hæmatopinus vituli* (Linn.), which is brownish in color. As the specimen figured came from the Burnett collection of the Boston Society of Natural History, together with those of the goat louse, the louse of the common fowl, and of the cat, they are undoubtedly naturalized here; the other specimens were collected by Mr. C. Cooke, and are in the Museum of the Peabody Academy of Science.

Fig. 25.



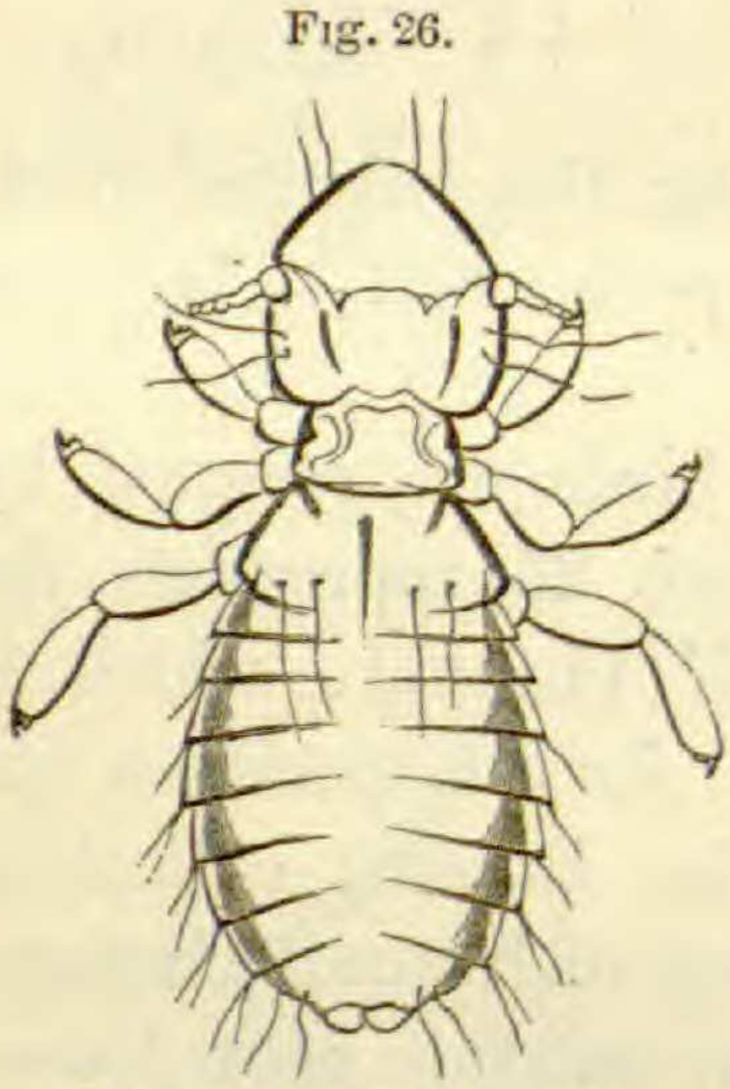
Louse of Cow.

The remaining parasites belong to the skin-biting lice, or Mallophaga, and I will speak of the several genera referred to here in their natural order, beginning with the highest one and that which is nearest allied to Pediculus. The species of Docophorus, figured on Pl. I, fig. 3, appears to be undescribed, and may be called *D. buteonis*. It lives beneath the

feathers of the Red-shouldered Hawk. It is honey-yellow, and the abdomen is whitish, with triangular chitinous plates on each segment, the two on the segment next to the last forming a continuous band. The head is longer than broad, with the trabeculæ (or movable horny process just in front of the antennæ), as long as the two basal joints of the antennæ, and extending to the middle of the second joint; the basal joint of the antennæ is rather thick, and the second joint is as long as the two terminal ones.

Another species (*Docophorus hamatus* n. sp., Pl. I, fig. 1), taken from the Snow Bunting (*Plectrophanes nivalis*) by Mr. C. A. Walker, Feb. 10, 1869, is white and has a large triangular head, with a very narrow prothorax, not much more than one-half as wide as the head; the abdomen is rounded oval, while the trabeculæ are very long and hooked.

Fig. 26.



Louse of Domestic Fowl.

An undescribed species of Nirmus (*N. thoracicus*, Pl. I, fig. 5) found on the Snow Bunting, is a large white form with the prothorax remarkably large, and but slightly narrower than the head, which is triangular. A narrow dark line extends along each side of the head and body. The trabeculæ are large, placed near the front of the head, and the antennæ in our specimens appear to be remarkably short, being only one-half as large as the trabeculæ and not reaching to the outer edge of the head. The abdomen is long, ovate.

The common barn-yard fowl is infested by a louse that we may call *Goniocotes Burnettii* (Fig. 27), in honor of the late Dr. W. I. Burnett, a young and talented naturalist and physiologist, who paid more attention than any one else in this country to the study of these parasites, and made a large collection of them, now in the museum of the Boston Society of Natural History. It differs from the *G. hologaster* of

Europe, which lives on the same bird, in the short second joint of the antennæ, which are also stouter; and in the long head, the clypeus being much longer and more acutely rounded; while the head is less hollowed out at the insertion of the antennæ. The abdomen is oval, and one-half as wide as long, with transverse, broad, irregular bands along the edges of the segments. The mandibles are short and straight, two toothed. The body is slightly yellowish, and variously streaked and banded with pitchy black.

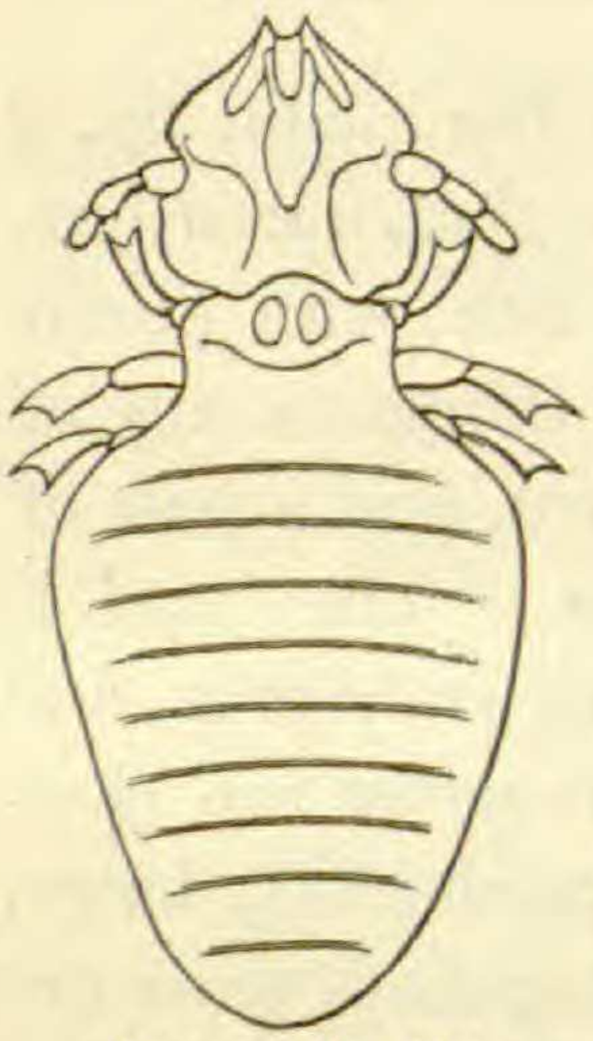
Of three species of Lipeurus, figured on the plate, fig. 2 represents a male of the louse of a crow, *L. corvi*, a new species. Its body is unusually broad, and is white, with pitchy black lines along the side of the head and thorax, a row of small blackish oval spots along the abdomen, and a pair of narrow black bands on each thoracic ring. The head is broad and triangular, with large, curved, long trabeculæ, and a prominence just behind the antennæ. The latter are slender and simple, with the two basal joints moderately large, and of equal size and length; the three terminal ones are slenderer; the third and fifth are of nearly the same length; the fourth is shorter, and the fifth ends in a rather sharp point. The mandibles are slender, acute, and much curved. The legs are rather stout, with two very small claws, and a small thumb-like tubercle opposed to them.

Another species (*L. elongatus*, n. sp., Pl. I, fig. 4, ♀) is allied to the *L. baculus* and *squalidus* of Europe. It is white, with pitchy black patches along the sides of the abdomen, and at the base of the legs. The head is pitchy black along each side. The two basal joints of the antennæ are of the same length; the third joint is a little larger and longer than the fourth, while the fifth is a third longer than the fourth, and is barrel-shaped. The third species (*L. gracilis*, n. sp., Pl. I, fig. 6, ♂) has a longer and narrower head with the clypeus more expanded and larger, and the edge of the body is dark, but the band is not so wide as in *L. elongatus*. There are two conical trabeculæ, and the antennæ

are as long as the head is broad at the place of their insertion; the second joint is much longer than the first; the third and fourth are together as long as the second, while the fifth is a quarter longer than the fourth joint. The mandibles are narrow, acute, with two unequal fine teeth.

To the genus Trichodectes belongs the *T. subrostratus* Nitzsch? (Fig. 27) identified by Dr. Burnett as probably the same as the European species. It is a parasite of the common cat. The front of the rather square head is elongated triangularly, with the apex ending in two acute spines on the under side of the head. The antennæ are three-jointed, with the middle joint a little longer than the last. The abdomen is oval, and the animal is whitish, with the head and thorax pale honey-yellow. The other species lives on the goat; it seems to be undescribed, and may be called the *Trichodectes capræ* (Fig. 28); it is closely allied to *T. longicornis* of Europe, but the head is not hollowed so much in front and is rather broader, while the third joint of the antennæ is more slender than in that species. It is reddish yellow, while the abdomen is edged with red, and is barred transversely with reddish brown.

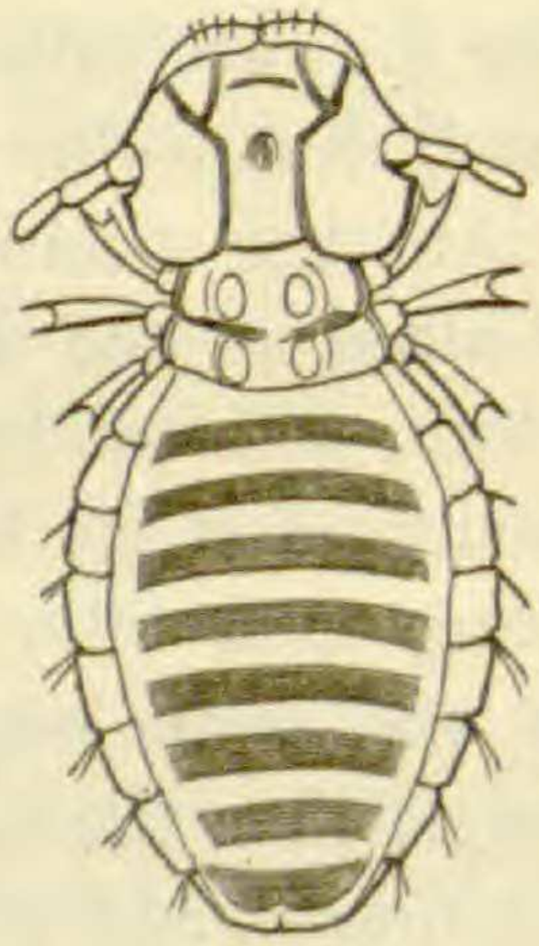
Fig. 27.



Louse of the Cat.

The Saddle-back Gull (*Larus marinus*) is infested by an undescribed species of louse which we may call *Colpocephalum lari*, Pl. I, fig. 1. It is dark brown and oval in form, with the head deeply indented in the middle; the anterior lobe, or clypeus (made too small in the figure), is twice as broad as long, with the basal half of the head a little wider than the head is long. The slender filiform antennæ are three-jointed, the last joint some-

Fig. 28.



Louse of the Goat.

what pointed. The third segment of the thorax is as wide as the head, and the legs are thick, the femora being broad. It is allied to *C. piceum* Denny, which in Europe lives on the Sandwich Tern.

The most degraded genus is Gyropus, of which Mr. C. Cook has found *G. ovalis* of Europe abundant on the Guinea pig. A species is also found on the porpoise; an interesting fact, as this is the only insect we know of that lives parasitically on any marine animal.

The genus Goniodes is of great interest from a morphological and developmental point of view, as the antennæ are described and figured by Denny as being "in the males cheliform (Fig. 29, *a*, male; *b*, female); the first joint being very large and thick, the third considerably smaller, recurved towards the first, and forming a claw, the fourth and fifth very small, arising from the back of the third." He farther remarks, "the males of this [*G. stylifer*, which lives on the Turkey] and all the other species of Goniodes, use the first and third joints of the antennæ with great facility, acting the part of a finger and thumb" (Denny's *Monographia Anoplurorum Britanniæ*, 1842, p. 155 and 157). The antennæ of the females are of the ordinary form. This hand-like structure, is so far as we know, without a parallel among insects, the antennæ of the Hemiptera being uniformly filiform,* and from two to nine-jointed. The design of this structure is probably to enable the male to grasp its consort and also perhaps to cling to the feathers and hairs, and thus give it a superiority over the weaker sex in its advances during courtship. Why is this advantage possessed by the males of this genus alone? The world of insects, and of animals generally abounds in such instances, though existing in other organs,

Fig. 29.
Antennæ of Goniodes.

* Except in Ranatra and Belostoma where they are disposed to be flabellate, *i.e.* rudely pectinated on one side.

and the developmentist dimly perceives in such departures from a normal type of structure, the origin of new generic forms, whether due at first to a "sport" or accidental variation, or, as in this instance perhaps, to long use as prehensile organs through successive generations of lice having the antennæ slightly diverging from the typical condition, until the present form has been developed. Another generation of naturalists will perhaps unanimously agree that the Creator has thus worked through secondary laws which many of the naturalists of the present day are endeavoring, in a truly scientific and honest spirit of inquiry, to discover.

In their claw or leg-like form these male antennæ also repeat in the head, the general form of the legs, whose prehensile and grasping functions they assume. We have seen above that the appendages of the head and thorax are alike in the embryo, and the present case is an interesting example of the unity of type of the jointed appendages of insects, and articulates generally.

Another point of interest in these degraded insects is, that the process of degradation begins either late in the life of the embryo or during the changes from the larval to the adult, or winged state. An instance of the latter may be observed in the wingless female of the canker worm, so different from the winged volant male; this difference is created after the larval stage, for the caterpillars of both sexes are the same, so far as we know. So with numerous other examples among the moths. In the louse, the embryo, late in its life, resembles the embryos of other insects, even Corixa, a member of a not remotely allied family. But just before hatching the insect assumes its degraded louse physiognomy. The developmentist would say that this process of degradation points to causes acting upon the insect just before or immediately after birth, inducing the retrogression and retardation of development, and would consider it as an argument for the evolution of specific forms by causes acting on the animal while battling with its fellows in the